VARIABLE SPEED ELECTRICAL MOTOR WITH SEPARATE START WINDINGS AND WITHOUT CENTRIFUGAL SWITCH

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RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Patent Application Serial No. 10/142,397, Filed May 8, 2002, entitled "VARIABLE SPEED ELECTRICAL MOTOR WITHOUT CENTRIFUGAL SWITCH," the entirety of which is incorporated herein by this reference.

FIELD OF THE INVENTION

This invention relates generally to electrical motors and, more specifically, to variable speed motors.

BACKGROUND OF THE INVENTION

Variable speed electrical motors are very popular for a wide range of uses. Typically, the switch mechanism which provides the motor with the capability of switching between two or more speeds is disposed on the rotating rotor portion of the motor, within the motor housing. Such switch mechanisms necessarily rotate as the rotor rotates. To connect the rotating switch to control wiring, some sort of brush and ring configuration must be provided.

One problem with such variable speed electrical motors is that the switching mechanism frequently fails. Also, the brush and ring configuration is prone to failure. In both cases, repair of the motor is awkward, time-consuming and expensive.

Another problem with such variable speed electrical motors arises when the user attempts to change the speed of the motor to a faster setting. With conventional variable speed motors, this action results in a momentary large increase in power consumption in the motor as the motor attempts to overcome inertial forces and ramp up the rotation of the rotor to the faster speed in a very short period of time. Such sudden increase in power consumption causes a large "spike" of required amperage to the windings and frequently trips out one of the thermal protectors on the motor. This results in a frustrating shutting down of the motor.

Accordingly, there is a need for a variable speed electrical motor which avoids this problem in the prior art.

SUMMARY OF THE INVENTION

The invention satisfies this need. In one embodiment of the invention, the invention is a variable speed electrical motor capable of operating at one of a plurality of discrete operating speeds. In the invention, the electrical circuitry for each speed includes both a start winding for only that speed and a start capacitor for only that speed.

In another embodiment of the invention, the invention comprises the variable speed electrical motor described above in combination with a switch for varying the speed of the motor, wherein the switch is disposed external of the motor housing.

DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description, appended claims and accompanying drawings where:

Figure 1 is an isometric view of an electrical motor combination having features of the invention;

Figure 2 is a side view of a water recreational combination employing the electrical motor combination illustrated in Figure 1;

Figure 3 is an electrical circuit diagram of a variable speed electrical motor having features of the invention; and

Figure 4 is a electrical circuit diagram for a variable speed motor of the prior art.

DETAILED DESCRIPTION

The following discussion describes in detail one embodiment of the invention and several variations of that embodiment. This discussion should not be construed, however, as limiting the invention to those particular embodiments. Practitioners skilled in the art will recognize numerous other embodiments as well.

The invention is an electrical motor combination **10** comprising a variable speed electrical AC induction motor **12** and a switch **14** for varying the speed of the motor **12**.

The electrical motor **12** has windings and a rotor (not shown) disposed within a motor housing **16**. Contrary to electrical AC induction motors of the prior art, the electrical motor **12** of the invention **10** has no speed-varying switch disposed within the motor housing **16**. The switch **14** for varying the speed of the motor **12** is disposed external of the motor housing **16**. The switch **14** is typically disposed within a separate switch box **18**.

The electrical motor combination of the invention **10** is ideal for use in a water recreational combination **20** such as a spa, hot tub or recirculation bath tub. Such a water recreational combination **20** is described in co-pending U.S. Patent Application Serial No. _____, filed March 14, 2002, entitled ADJUSTABLE WATER THERAPY

COMBINATION, the entire contents of which are incorporated herein by this reference.

Figure 2 illustrates a typical portable spa **20** having a water basin **22** with side walls **24**. Water is circulated from the bottom of the water basin **22** through water circulation lines **25**, a centrifugal water pump **26** and back to the water basin **22**, typically via water injection jets (not shown). The variable speed AC induction motor **12** is used to drive the water pump **26** so that water entering the water basin **22** via the water injection jets can be varied with respect to intensity and pulse characteristics. Speed control of the electrical motor **12** is accomplished by the switch **14** which is disposed within a switch box **18** external of the electrical motor **12**. Main line operating power is wired to the switch box **18** via main power wires **28**. Electrical motor power is provided from the switch box **18** to the electrical motor **12** via electrical motor input wires **30**. The switch **14** within the switch box **18** controls the amount of main line power to the electrical motor **12**. Control of the switch **14** can be made via a control panel (not shown) which is operably attached to the switch **14** within the switch box **18** by control wires **32**. As illustrated in Figure 2, the pump **26**, water circulation lines **25**, electrical motor **12** and switch box **18** can be conveniently located within a spa surround **34**. Large doorways **36** within the spa surround **34** provide easy access to the pump **26**, motor **12** and switch box **18** for maintenance purposes.

As can be readily appreciated, maintenance on or replacement of the switch **14** is easily accomplished within the invention because the electrical motor **12** does not have to be opened to obtain access to the switch **14**. Rather, the switch **14** is easily accessed by simply opening the switch box **18**.

In a preferred embodiment of the invention, the invention is the variable speed electrical motor **12** described immediately above in combination with a switch **14**, such as previously described above, for varying the speed of the motor **12**, wherein the switch **14** is

disposed external of the motor housing **16**.

In another preferred embodiment of the invention, the electrical motor **12** is a variable speed electrical motor capable of operating at one of a plurality of discrete operating speeds. In the invention, the electrical circuitry for each of the plurality of discrete operating speeds includes both a start winding **40** for only that speed and a start capacitor **42** for only that speed. Such a circuitry (for a two-speed electrical motor **12**) is illustrated in Figure 3. Such a circuitry is contrasted with the electrical circuitry of variable speed electrical motors of the prior art wherein there is only one start winding and only one start capacitor for the entirety of the motor. The circuitry for such a motor is illustrated in Figure 4.

The invention successfully overcomes the aforementioned problems in the prior art. By providing a switch for varying the speed of the motor external of the motor housing, prior art problems with rotating switch contacts and brush and ring configurations are eliminated. Moreover, by providing a separate start winding and a separate start capacitor for each speed in the motor, large amperage "spikes" are eliminated when switching the motor from a lower speed to a higher speed. For example, in one embodiment of the invention, the switching from a low speed to a high speed setting only caused an amperage "spike" of about six amps, whereas, in an otherwise identical motor of the prior art, amperage "spikes" of 50 amps or more are frequently encountered.

Having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention as set forth hereinabove and as described hereinbelow by the claims.